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(19) (CA) **APPLICATION FOR CANADIAN PATENT** (12)

(54) Prosthetic Joint

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(57) 10 Claims

Abstract

The invention relates to a prosthetic joint, especially a knee or hip joint, with an upper joint part (1), a lower joint part (2), a joint axis (3) connecting these two joint parts (1, 2) pivotably with one another and connected rotatably with one joint part (1), and a damping of the joint swing. To achieve in particular a more compact design of the joint, it is proposed according to the invention that the damping be integrated into one (2) of the two joint parts (1, 2) and act directly on joint axis (3) nonrotatably connected with the other joint part (1).

[Two sheets of drawings attached]

Prosthetic Joint

The invention relates to a prosthetic joint, especially a knee or hip joint, with an upper joint part, a lower joint part, a joint axis connecting these two joint parts together in pivotable fashion, and nonrotatably connected with one joint part, and a damping of the joint swing.

Damping a knee joint hydraulically is known. A hydraulic damping cylinder located outside the joint is provided for this purpose, said cylinder being articulated at one end on the lower joint part and acting with its piston rod on a lever connected with the upper joint part.

The goal of the invention is to improve this design, especially as regards its function.

This goal is achieved according to the invention by the following features:

a) damping is integrated into one of the two joint parts and acts directly on the joint axis nonrotatably connected with the joint part;

b) damping comprises a closed displacement chamber surrounding the joint axis concentrically around its circumference at least partially, said chamber being divided into two sectional chambers by the joint axis designed as a rotary piston;

c) the sectional chambers of the displacement chamber are connected together by two throttle-check valves, connected in parallel and acting in opposite directions;

d) both throttles are controllable externally, separately from one another.

The design according to the invention, in its application as a knee joint, in addition to the known braking knee, permits a swing phase control in which the swing resistance can be adjusted separately for flexure and extension.

The throttles can basically be controlled mechanically or by an electrical positioning drive. It is advantageous according to the invention for a throttle to be controlled by an axially displaceable throttle rod whose displacement can be effected for example by a manually adjustable knurled screw or the like.

Particularly in a prosthetic joint designed as a knee joint, it is advantageous for a force loading the joint to cause a predefined closure of the bending throttle. This can be accomplished in the design in the form of a telescopic, force, or moment control.

Preferably, the rotary piston has a rectangular piston plate abutting the two ends and the cylindrical inside wall of the enclosed displacement chamber by a sealing frame. The latter can preferably be held in place by a retainer screwed to the piston plate. This results in a displacement chamber enclosed on all sides with a single defined leak provided in the area of the rotary piston seal. It is advantageous in this regard for the rotary piston seal sealing the displacement chamber from the exterior to be located outside the rotary piston bearing. Lubrication of the rotary piston bearing is provided by the pressure prevailing the displacement chamber, in other words by the hydraulic oil which should therefore have superior lubricating properties.

Additional features of the invention are the subject of the subclaims and will be explained in greater detail in

conjunction with further advantages of the invention with reference to an embodiment.

The drawing shows one embodiment of the invention as an example.

Figure 1 shows a knee joint in a side view;

Figure 2 is the representation in Figure 1 in an end view;

Figure 3 is the representation in Figure 1 in a top view;

Figure 4 is a lengthwise section along line A-A in Figure 2;

Figure 5 is a lengthwise section along line C-C in Figure 2; and

Figure 6 is a cross section along line B-B in Figure 1.

A knee joint is shown as an example of a prosthetic joint, said knee joint consisting of an upper joint part 1 and a lower joint part 2 located slightly eccentrically with respect to the latter. The pivotable connection of the two joint parts 1, 2 is provided by a joint axis 3 nonrotatably connected with upper joint part 1. Upper joint part 1 abuts the cylindrical surface 4 of lower joint part 2 with its partially cylindrical lower side. Because of the eccentric arrangement of the two parts with respect to one another, during a joint swing upper joint part 1 rolls with its lower side on cylindrical surface 4, which therefore serves as a joint buffer over its entire surface. A separate joint stop is therefore unnecessary.

To damp the joint swing, in the embodiment shown hydraulic damping is provided that is directly integrated into lower

joint part 2, said damping acting directly on joint axis 3. Hydraulic damping comprises an enclosed displacement chamber 5 surrounding joint axis 3 over its circumference partially concentrically, said chamber being divided by joint axis 3 in the form of a rotary piston into two sectional chambers 5a, 5b. For this purpose, joint axis 3 is provided witn a rectangular piston plate 6 extending in the axial and radial directions, said plate abutting in sealing fashion the two end walls of displacement chamber 5 with its two radially extending end edges and abutting the cylindrical inside wall of displacement chamber 5 with its axially extending lengthwise edge. Preferably this seal is provided by a sealing frame 7, mounted on piston plate 6 by means of a retainer screwed to piston plate 6 and not shown in the drawing.

Displacement chamber 5 is sealed from the exterior by a rotary piston seal 8 located outside rotary piston bearing 9. Lubrication is provided by the pressure prevailing in the displacement chamber 5, with displacement chamber 5 preferably being filled with a hydraulic oil with superior lubricating properties.

Sectional chambers 5a, 5b are connected together by two throttle-check valves 10 connected in parallel and acting in opposite directions. These valves are located in two bores 11 provided side by side in lower joint part 2, said bores running perpendicularly to joint axis 3 and being sealed from the exterior by sealing plugs 12.

A throttle rod 13 is provided to control the throttle of each throttle-check valve 10 in the embodiment shown, said rod being displaceable lengthwise by an adjusting device not shown in greater detail, for example a manually operated knurled screw, and projecting with its upper free end shown

in Figure 5 to a greater or lesser depth into the flow cross section of the flow connection between the two sectional chambers 5a and 5b. The possibility of separate adjustment of the two throttle rods 13 allows the swing resistance to be adjusted separately for flexure and extension. It is also advantageous in this regard for loading of the knee to result in closure of the bending throttle. This is ensured by a telescopic, force, or moment control not shown in the drawing.

Claims

1. Prosthetic joint, especially a knee or hip joint, with an upper joint part (1), a lower joint part (2), a joint axis (3) joining these two joint parts (1, 2) pivotably with one another and nonrotatably connected with one joint part (1), and a damping of the joint swing, characterized by the following features:

   a) damping is integrated into one (2) of the two joint parts (1, 2) and acts directly on joint axis (3) nonrotatably connected with joint part (1);

   b) the damping has an enclosed displacement chamber (5) concentrically surrounding joint axis (3) at least partially or over its circumference, said chamber being divided by joint axis (3) made in the form of a rotary piston (3, 6, 7) into two sectional chambers (5l, 5b);

   c) sectional chambers (5a, 5b) of displacement chamber (5) are connected together by two throttle-check valves (10) connected in parallel and acting in opposite directions;

   d) both throttles are controllable from the exterior separately from one another.

2. Prosthetic joint according to Claim 1 characterized in that the control of a throttle is provided by an axially displaceable throttle rod (13).

3. Prosthetic joint according to Claim 2 characterized in that a manually adjustable knurled screw or the like is provided for displacing throttle rod (13).

4. Prosthetic joint according to Claims 1, 2, or 3 characterized in that a force loading the joint causes a predefined closure of the bending throttle.

5. Prosthetic joint according to one of the foregoing claims characterized in that rotary piston (3, 6, 7) comprises a rectangular piston plate (6) which abuts the two ends and the cylindrical inside wall of displacement chamber (5) by a sealing frame (7).

6. Prosthetic joint according to Claim 5 characterized in that sealing frame (7) is held in place by a retainer screwed to piston plate (6).

7. Prosthetic joint according to one of the foregoing claims characterized in that the rotary piston seal (8) sealing displacement chamber (5) from the exterior is located outside rotary piston bearing (9).

8. Prosthetic joint according to one of the foregoing claims characterized in that two bores (11) are provided for mounting the two throttle-check valves (10) in joint part (2) receiving displacement chamber (5), said bores being sealed from the exterior by a sealing plug (12).

9. Prosthetic joint according to one of the foregoing claims characterized in that the damping medium is a hydraulic oil with superior lubricating properties.

10. Prosthetic joint according to one of the foregoing claims characterized in that upper joint part (1) abuts with its partially cylindrical underside, the cylindrical surface (4) of lower joint part (2) provided eccentrically with respect to the upper joint part.

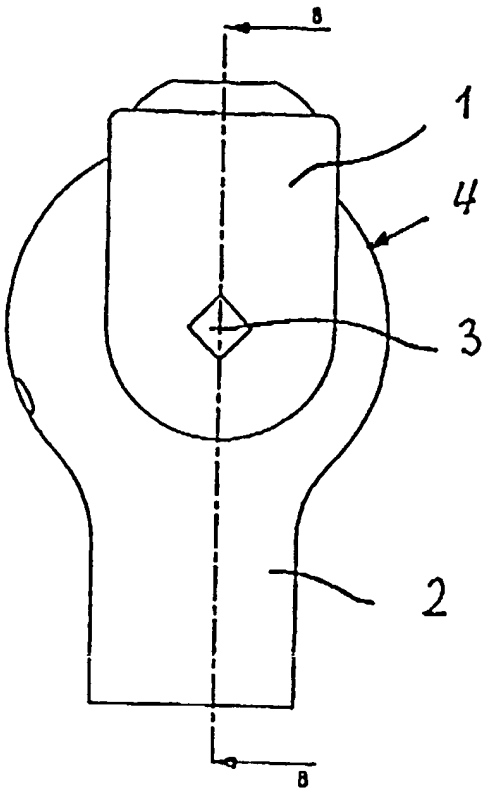


Fig. 1

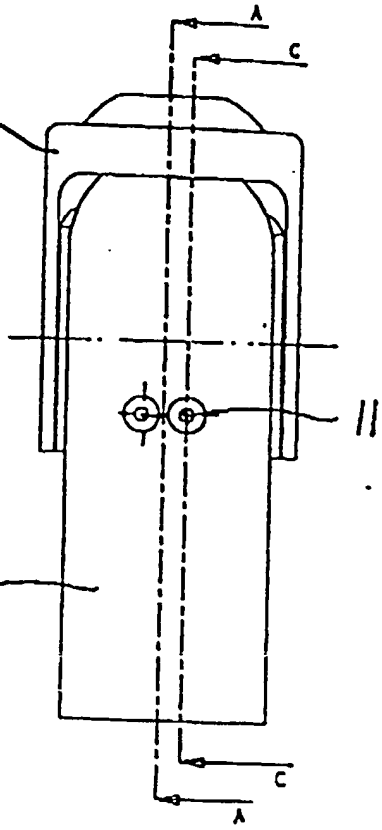


Fig. 2

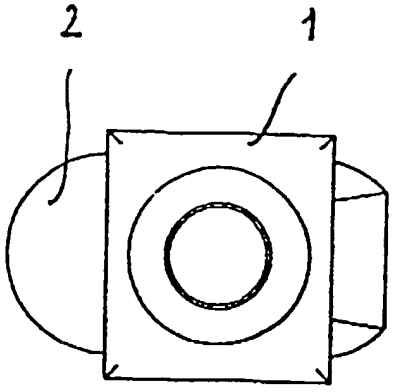


Fig. 3

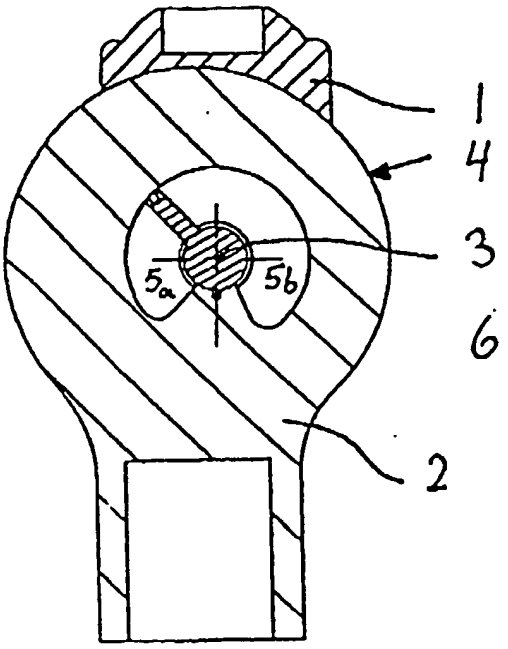
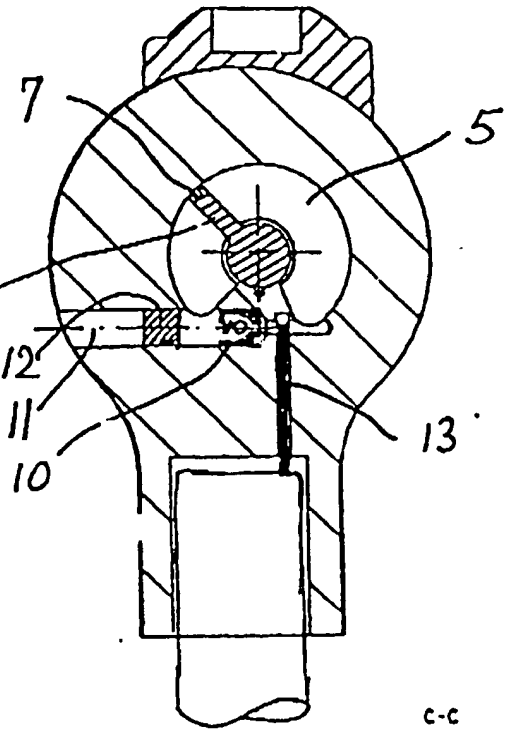


Fig. 4 A-A



C-C

Fig. 5

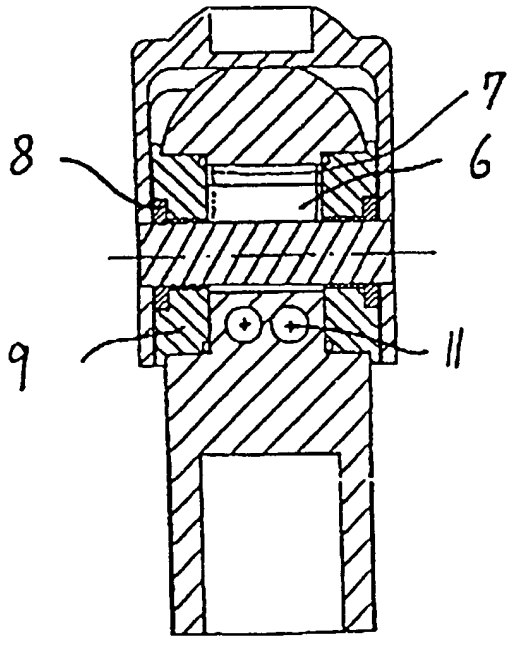


Fig. 6

B-B

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